

Readers are encouraged to submit brief articles or ideas for articles. Correspondence, including requests for changes in the mailing list, should be addressed to Randy Brown, California Department of Water Resources, 3251 S Street, Sacramento, CA 95816-7017.

USGS Hydrodynamics Program

It is important to quantify the net circulation pattern in San Francisco Bay and the Sacramento-San Joaquin Delta, because the pattern determines the response of water masses to the physical forcings of tides, freshwater inflow, and wind over weeks and months. Net circulation over a few tidal cycles is difficult to measure because it is spatially heterogeneous and its magnitude is much smaller than the magnitude of tidal circulation. A combination of mathematically modeling circulation and collecting hydrodynamic data may overcome this difficulty.

Valuable information can be derived from the right field data, and the models require extensive field data for calibration and validation. Our approach is to assemble the datasets most needed for model calibration and validation and to collect and analyze additional data important to understanding the major physical processes in the bay.

The USGS hydrodynamics workplan, developed in 1984 as part of the Delta Outflow Study, states that the broad purpose of the program is to "determine the magnitude, duration, and location of biologically significant variations in hydrodynamics, salinity, suspended solids, and pollutant transport within the bay which result from changes in delta outflow".

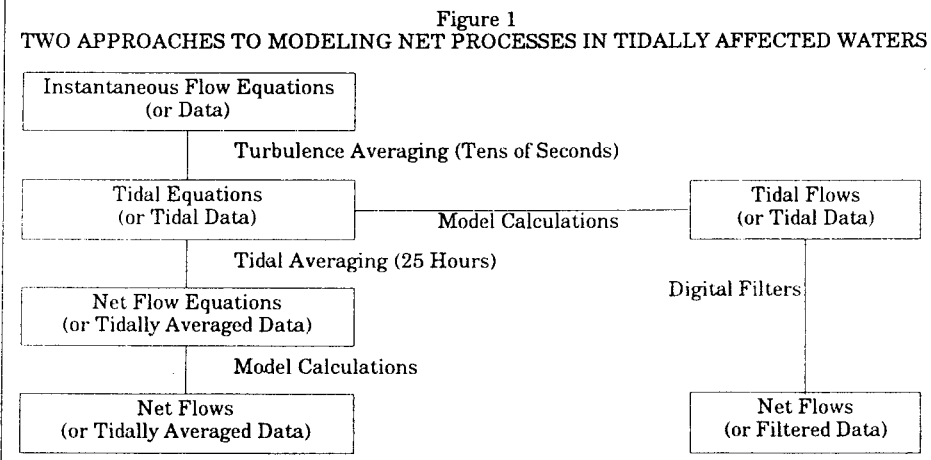
Four major objectives have guided the program:

- Develop salinity-outflow-time relationships for San Francisco Bay salinity stations.
- Describe the relationships between delta outflow and horizontal circulation patterns in San Francisco Bay, and determine variations in the tidal exchange between shallow tidal flats and deep channel areas with changes in delta outflow (horizontal circulation).
- Describe the relationship between delta outflow and gravitational circulation patterns in San Francisco Bay (gravitational circulation).
- Evaluate changes in suspended solids and nutrients with variation in delta outflow.

The fourth objective has not yet been addressed. The others are being addressed by

data collection and modeling efforts. The primary focus has been on building tools to quantify these needs. The Interagency Hydrodynamics Committee, formed in May 1990, is reviewing the needs of the Interagency program and will set priorities for future hydrodynamics work.

Figure 1 shows two paths to predicting net circulation in the bay and delta. The path that includes tidal averaging the flow equations is inadequate because net tidal circulation is a large part of the overall net circulation. In addition, no one has been able to parameterize the net tidal processes. Therefore, the USGS approach is to make calculations at the tidal time scale and to compare model results and data at the net time scale (low-pass filtered model results compared with low-pass filtered data).



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A 3-dimensional tidal model that includes the entire bay seaward of Chipps Island is part of the long-term plan. Detailed calibration and validation of such a model will require a few years of work after a suitably accurate and efficient model code is selected. We are working on two 2-dimensional models to answer some questions during the intervening period. Validation time scale of all three models is tidal. Key points of the models are:

Geographic Area	Flow and Conservative Transport Equations	Modelers
San Pablo Bay	Non-Linear, Vertically Averaged 2-Dimensional	L.Smith R.Cheng
Whole Bay	Linearized Vertically Averaged 2-Dimensional	J.Bureau R.Cheng
Suisun Bay	Non-Linear 3-Dimensional	P.Smith

A status report on the models was published in 1989 (Smith and Cheng 1989).

Data and computer programs most closely associated with the modeling are shown in Figure 2. We now have a time-series database that contains all the current meter and sea level data published by Cheng and Gartner (1984) as well as current meter data collected since then. The database also contains most of the salinity, sea level, and meteorological data collected by USGS and DWR at the sites shown in Figure 3. Retrieval and filtering programs produce boundary condition data with which to drive model simulations and low-pass filtered data to compare with model predictions. In addition, all of the depths and depth contours on the navigational charts for San Francisco Bay have been used to create a bathymetric database for the bay, and retrieval and editing programs have been written to create and refine model depth grids (Bureau and Cheng 1989).

Other major tools of the data collection program are summarized below:

Tool	Principal Use
Acoustic Doppler current profiler	Vertical profiles of horizontal currents
Seabird CTD	Vertical profiles of salinity and temperature
Doppler and moving boat software	Tidal flux through estuarine section
Self-contained Doppler profiler	Time series of current profiles
Self-contained current meters	Time series of currents and salinities

The acoustic Doppler current profiler and CTD profiler are mounted aboard the research vessel *Rantz* and have been used in

Figure 2
DATA COLLECTED (in boxes) AND COMPUTER PROGRAMS WRITTEN (between boxes)
TO SUPPORT HYDRODYNAMIC MODELING OF SAN FRANCISCO BAY

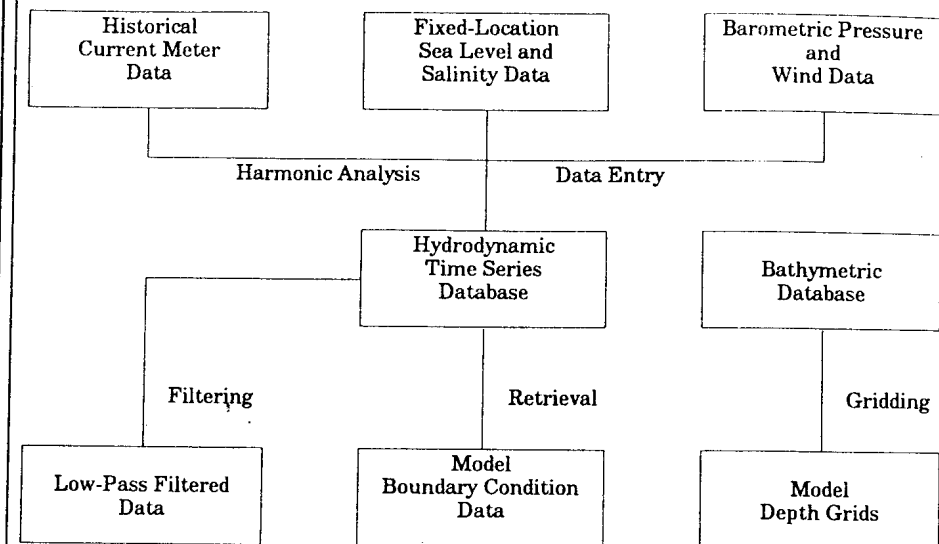
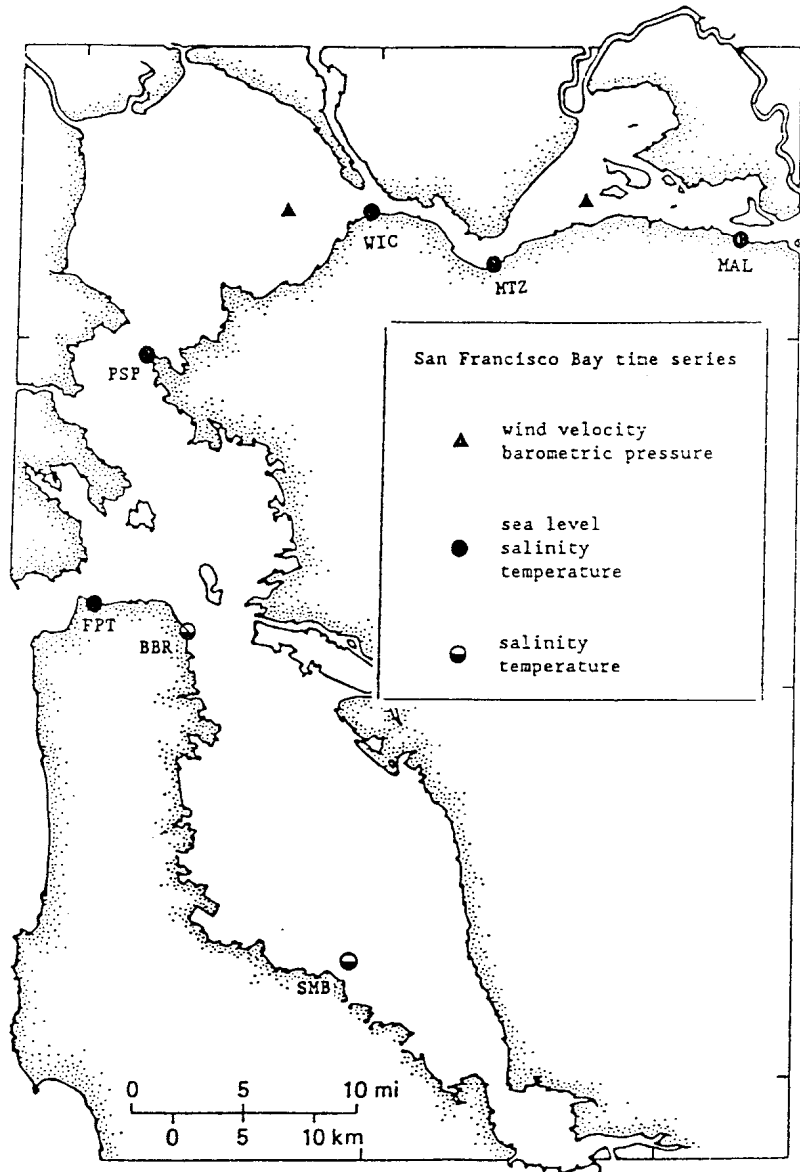


Figure 3
USGS AND DWR MONITORING SITES FOR
SALINITY, SEA LEVEL, AND METEOROLOGICAL DATA



a USBR-led project to collect longitudinal profiles of salinity and velocity in the main channel of the northern bay, in a project to collect salinity profiles in South Bay (Powell and others 1989, Cloern and others 1989), and in a project to collect sediment and velocity profiles in Suisun Bay.

We developed the software system to measure tidal fluxes in a channel cross section (Simpson and Oltmann 1990). We have used the software to measure tidal discharges at numerous locations in the

delta and to measure net delta outflow at Chipps Island.

The self-contained Doppler profiler was used to measure gravitational circulation in Carquinez Strait for nine months during 1988 (Burau and others 1990).

Gartner and Oltmann (1990) evaluated the suitability of several types of current meters for measuring currents in very shallow water (about 6 feet).

—Peter Smith and Larry Smith, USGS

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- Smith, PE, and RT Cheng. 1989. "Recent Progress on Hydrodynamic Modeling of San Francisco Bay, California". ASCE Specialty Conference on Estuarine and Coastal Circulation and Pollutant Transport Modeling. Newport, RI. November 15-17, 1989.

In the December 1990 *Newsletter*, Mike Simpson's biography was omitted from the "Unit of the Month". We apologize.

Michael Simpson began his career at the age of 17 as an amateur radio operator. Since then, he has worked in the field of high frequency signal analysis for the Navy and has operated his own electronics repair business. The USGS hired him in 1974. He specializes in state-of-the-art acoustic instrumentation used for hydrologic investigations. For the San Francisco Bay hydrodynamic studies, he has developed, tested, and documented a new-generation discharge measurement system that uses a vessel-mounted acoustic Doppler current profiler. Mike is also responsible for a bottom-mounted ADCP system and other acoustic instrumentation.

University Academic Research Involvement Program

The first grants selected for funding through the joint San Francisco Estuary Project/Interagency Program University Academic Research Involvement Program have gone to:

- Dr. R. Tjeerdema, U.C. Santa Cruz (Bioconcentration in Striped Bass)
- Dr. J. Harvey, Moss Landing Marine Laboratory (Habitat Use by Harbor Seals)
- Dr. J. Largier, Scripps (Water Exchange through the Golden Gate)
- Dr. W. Bennett, U.C. Davis (Interaction of Starvation and Predation on Striped Bass Larvae)

The second round of Requests for Proposal is underway. University researchers interested in receiving a copy of the information brochure may contact Dr. Perry Herrgesell at 209/466-4421.

IESP Annual Workshop at Asilomar

The agenda of the 1991 IESP Workshop (February 20-22) included presentations on technical activities within the IESP and some on the outside but related to the program. Related talks included:

- Pesticides and aquatic toxicity in the San Joaquin River (Chris Foe, Regional Water Quality Control Board)
- Toxic organic contaminants in the San Francisco Bay estuary (Larry Smith for Kathy Kuivilla, USGS)
- Coastal ocean and river effects on salinity in the San Francisco Bay estuary (Dave Peterson, USGS)

All presentations were well done and well received by those attending (about 140 of us).

On the second evening, Ken Lentz (USBR) moderated an informal and spirited panel discussion on "Where Are We Going With Delta Facilities?" Panel members were Ed Huntley (DWR), Pete Chadwick (DFG), Dick Clemmer (Metropolitan Water District of Southern California), and Tom Zuckerman (Central Delta Water Agency). Given this group of long-time experts on facilities, the "P-word" became a topic of emotional discussion. (For the benefit of non-Californians, the Peripheral Canal has been studied for decades as a solution to problems associated with moving water through the Sacramento-San Joaquin Delta, and it has been the center of considerable controversy the whole time.)

This year's workshop included a professional and informational poster session. Poster topics ranged from selenium studies to entrapment zone work to striped bass otolith reading. This session provided opportunity for technical exchanges between participants. Some participants suggested a formal exchange of posters between agencies. Anyone who has need to display any of the posters may contact Perry Herrgesell at 209/466-4421.

Social interaction and free time were part of the agenda, and we used these times to get to know each other on a personal level.

The 1992 workshop will be at Asilomar again — February 19-21. If you have ideas for next year or comments on this year's workshop, please contact me.

—Perry Herrgesell, DFG

Update on Spatial Distribution of *Potamocorbula amurensis*

The Department of Water Resources Bay/Delta Monitoring and Analysis Unit completed a special study to determine the spatial distribution of *Potamocorbula amurensis* in the upper San Francisco Bay estuary between San Pablo Bay and the western Delta. Field sampling was completed in September 1990. A report will be completed in April 1991.

One benthic grab sample was collected at each of 215 sites distributed uniformly over the survey area. Each sample was examined to estimate the proportion of different substrate types (e.g., sand, silt and clay, or shell). Each sample was then washed over a 0.5 mm² screen, and the remaining material was preserved for laboratory analysis to determine the number and size of any clams present.

Substrate analysis results show the survey area is dominated by silt and clay (fines). The increased proportion of fines is an estuary-wide phenomenon, probably the result of drought-associated low flows.

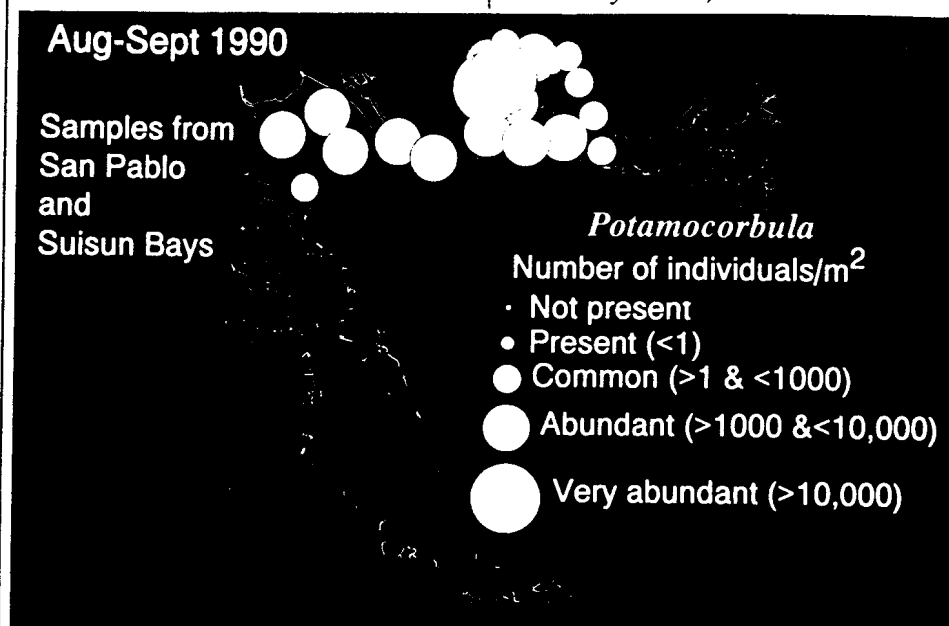
Laboratory analysis results show the overall distribution of *P. amurensis* was uniform over a large portion of the survey area. Clams were collected from every site sampled between San Pablo Bay and Sherman Island except for eight sites in the center of the ship channel between Martinez and

Point Pinole. This is the first study to intensively sample Suisun Marsh for *P. amurensis*, and results show the clam is well established in this region. *P. amurensis* was not collected from any site east of Sherman Island. Data from sites within specific regions were combined to determine mean abundance of clams over the survey area (see the figure below). Abundances of *P.*

amurensis have remained the same or increased somewhat over measurements made by USGS in 1987.

Most clams collected were less than half the maximum observed size of 26 mm. This suggests something is limiting growth of *P. amurensis* or predators are removing individuals in the larger size classes.

—Zach Hymanson, DWR



Noteworthy —

- The Bay Study Advisory Panel will hold its first meeting on April 16 and 17 in Sacramento. This panel of technical experts from around the country will provide suggestions for San Francisco Bay studies.
- Planning continues for the fall meeting of the Estuarine Research Federation to be held November 10-14 in San Francisco. John Conomos and Randy Brown are organizing a Bay/Delta poster session and Joe Loesch (Virginia Institute of Marine Science) is trying to organize a contributed papers session on East Coast/West Coast striped bass studies.

Staff Notes

- **Pete Antilla**, the USGS Coordinator, will soon be transferring to the office of the Regional Hydrologist in Menlo Park. John Klein, Chief of the USGS Sacramento Region, will announce a replacement within the next few weeks.
- **Felise Woods** has been hired for a second term as a seasonal clerk to help with clerical work at the DFG Bay-Delta office. Felise lives in Oakland and commutes home on weekends.
- **Mike Sullivan** has replaced Sonia Hamilton as a Fishery Biologist on DFG's Delta Outflow/San Francisco Bay Study. (Sonia transferred to the Delta Planning staff last year.) Mike earned a BA at Fresno State and an MS at Humboldt State. His previous job was with the USFWS Land and Water Resources Development Planning Program in Sacramento.
- As a temporary Fishery Biologist at the USFWS office in Stockton, **Mark Pierce**

will be responsible for much of the spring field work. He has been working as a DFG seasonal aid with the San Francisco Bay Project for the last few years.

- **Simone Dumas-Jones**, a new Office Assistant at DFG Stockton, previously worked for the American Heart Association and for a semiconductor company. She is an accounting major at Delta College.
- **Brenda Grewell** (Environmental Specialist III, DWR) recently left the Compliance Monitoring and Analysis Section to join the Interagency Program staff. She is working on the EIR for the Western Suisun Marsh salinity control project.
- **Ted Sommer** (Environmental Specialist II) also joined DWR's Interagency Program staff recently. He will be assigned to the Feather River study and Article 7 staff support.

First Annual IESP Public Forum

On Thursday, March 28, 1991, the Interagency Ecological Study Program held its first annual Public Forum at the Contra Costa Water District Auditorium in Concord. The purpose of the forum, as stated by Pete Chadwick (Chairman of the IESP Coordinators) in his opening remarks, was to inform the public about IESP activities and programs, to encourage feedback regarding the IESP, and to increase the visibility of the program. An underlying goal was to encourage development of a constituency for the IESP. The idea for this forum emerged from comments provided to IESP members at the 1990 workshop at Asilomar.

Perry Herrgesell (Study Manager) provided an overview of the IESP, including its history, goals, and structure, then the

technical committee chairpersons covered activities in their respective areas.

The highlight of the event was a panel discussion by four people outside IESP who are involved in estuarine protection and use: David Schuster (consultant for the State Water Contractors), Jason Peltier (Manager of the Central Valley Project Water Association), John Krautkramer (Senior Attorney for Environmental Defense Fund), and Barry Nelson (Executive Director of Save San Francisco Bay Association). The panel provided valuable advice. For instance:

- IESP should clearly tell SWRCB the implications of proposed standards or actions.

- IESP should base its studies on an ecosystem approach.

- IESP should develop a conceptual model of the system.

- IESP should not cut funding for the hydrodynamics program.

- IESP should clearly show relevance of program activities.

- IESP needs to restructure the program to allow outside input to program management.

The forum ended with six technical presentations highlighting findings from the Fish Facilities, Fisheries and Water Quality, Hydrodynamics, and Delta Outflow/San Francisco Bay Study programs.

—Perry Herrgesell, DFG.

Suisun Marsh Planning

The Suisun Marsh coordinators met in January to discuss two petitions to the Board, operation of the Salinity Control Gates, and planning for assessment of the impact of the Plan of Protection on threatened and endangered organisms listed after the plan was approved. Although Suisun Marsh is no longer formally part of the Interagency Program, considerable communication between the two programs remains.

The Suisun Marsh coordinators are Pete Chadwick (DFG), Dan Chapin (Suisun Resource Conservation District), Gary

Sackett (USBR), and Randy Brown (DWR).

Action on agenda items included:

- Agreed to petition SWRCB to extend for one year the time to commence compliance for all western marsh stations. If approved, the new date will be October 1994.

- Agreed to petition SWRCB to test effectiveness of the control gates in helping meet internal marsh standards without a Chipps Island standard. (Although a biological assessment of potential im-

pacts of this action was prepared, the petition was never submitted to SWRCB.)

- Adopted a process by which the Technical Coordinating Committee becomes formally involved in developing operation schedules for the control gates.

- Approved a schedule calling for a final DFG/USFWS/USBR/DWR study plan for Suisun Marsh threatened and endangered species by March 1, 1991.

—Randy Brown, DWR

Publications

- The DAYFLOW update has been prepared for the 1990 water year (October 1989 through September 1990). Call Joyce at 916/322-6226.

- We have a very limited supply of "Contribution of Sacramento Basin Hatcheries to Ocean Catch and Escapement of Fall Chinook Salmon". The report was prepared for DWR by Steven Cramer of Corvallis, Oregon.

Call Mary at 916/323-7203.

Natural History Tour of Belize

Pete Chadwick, Chairman of the Interagency Coordinators, spent a 2-week vacation on a natural history tour of Belize, the least densely populated country in Central America. Much of the country is still rain forest, but large-scale conversion to agriculture is occurring in areas accessible by road. Land can be purchased at a nominal cost from the government on the condition it be cleared and put into production within 3 years. Much of the land is underlain by limestone. Hence, it apparently remains suitable for agriculture for many years, rather than quickly becoming unproductive as the Amazon rain forest does. Interestingly, large tracts of land were denuded by the Mayans, and then abandoned in about AD 1000. That land had reforested naturally by the time caucasians invaded the country.

Conservation is an issue, largely led by private organizations. For example, the Belize Audubon Society and the World Wildlife Fund were instrumental in recent establishment and operation of the world's largest jaguar preserve.

Interagency Ecological Study Program
NEWSLETTER
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Interagency Ecological Study Program for the Sacramento-San Joaquin Estuary

NEWSLETTER

California Department of Water Resources
State Water Resources Control Board
U.S. Bureau of Reclamation

A Cooperative Effort of:

U.S. Army Corps of Engineers

California Department of Fish and Game
U.S. Fish and Wildlife Service
U.S. Geological Survey

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